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United States Department Of Agriculture | Forest Service | Shasta-Trinity National Forests

Reply To: 3420 Date: December 6, 1988

Subject: Evaluation of Black Stain Root Disease in Mosquito F and 8 Plantations

To: Forest Supervisor, Six Rivers National Forest

On November 29, 1988, Dave Schultz, entomologist, and I visited two Douglas-fir plantations in the Mosquito Compartment on the Lower Trinity Ranger District. We were accompanied by Danny Heavilin, District TMO.

The two stands that we visited were Mosquito F and Mosquito 8 in T. 5 N., R. 5 E., section 28. Both plantations are about 18 years old and are part of a larger area of approximately 150 acres of Douglas-fir plantations. The stands are comprised of sapling and pole-size Douglas-firs. They were precommercially thinned in 1985.

Mortality of Douglas-fir was occurring in both plantations. At least one group of dead trees was present in each of the plantations. In addition to the dead trees, several green trees in the immediate vicinity did not appear healthy. The foliage on these trees was yellow and sparse. The last several year's internodes were short compared with other trees in the plantation. In several cases, the trees also had a large number of small cones. The pattern of damage suggested the presence of a root disease, the most likely one being black stain root disease caused by Leptographium wageneri. We chopped into the base of several dead trees to look for the typical stain but could not find evidence of the disease. We exposed the roots of a symptomatic live tree and found the dark stain following the annual rings indicative of black stain root disease.

The fungus, L. wageneri, has several strains which attack a number of hosts. The strain on Douglas-fir is specific to this host and is not known to attack other tree species. The fungus occurs in the roots and lower boles of infected trees. It occupies the vascular tracheids in the sapwood, blocking water transport. Several root-inhabiting insects are implicated as vectors, primarily a bark beetle, Hylastes nigrinus, and a weevil, Steremnius carinatus. These insects feed and breed in the phloem and cambium on roots of cut and declining Douglas-firs. Phloem may be suitable for attack for 2 years after tree death. It is believed that the fungus sporulates in the insect galleries and emerging adults pick up the spores on their body. The fungus is then transmitted to another site when these adults feed on or breed in new roots. Once established in a root, the fungus grows through the tracheids and can attack the roots of surrounding Douglas-firs by growing across root contacts or for short distances through soil. Disease centers may continue to expand until there is a break in the root contacts, such as by a non-susceptible species, a road, or a stream.

There is no known method of directly controlling this disease once it is established in a stand. Neither is it known what conditions actually cause the

initiation of new centers. There is evidence that precommercial thinning is associated with increased incidence of black stain root disease, especially where previous harvesting was done with a tractor. It is not known if the presence of the disease in a stand prior to thinning influences the occurrence of additional infections following thinning.

The size of the two centers we observed suggests that the fungus was established before the thinning in 1985. However, the fungus can apparently spread rapidly in roots and may have been introduced into the new stumps immediately after thinning, with subsequent spread in the stands. The condition of the stumps at this time is not conducive to attack by the insects and it is not expected that new centers will develop around any existing stumps. New infection centers might develop around trees that are weakened by stress factors, such as drought and brush competition.

MANAGEMENT ALTERNATIVES

1. No Action. The disease will continue to spread outward through root contacts in existing centers. The rate of spread of the disease has been measured at 4-12 feet per year in other locations. Natural barriers will not be effective in limiting further spread of the disease within existing centers. Most of the Douglas-firs in the root disease centers will die before becoming merchantable. As these plantations approach age 30 the effects of the disease will lessen and mortality will subside. The mortality pockets created by the disease will be occupied by brush, probably tanoak and manzanita, and may each be several tenths of an acre in size.

Additional root disease centers may develop around weakened trees if they are attacked by insects vectoring the fungus. Because the trees have been spaced and are above the brush, most of them should be vigorous and not attractive to the insects. If new centers are created, then outward spread will progress as described above.

2. Remove Trees from Root Disease Centers. Root disease centers would be identified on the ground based on above ground symptoms. A buffer strip of 75 feet around each center would also be identified. All Douglas-firs in the root disease centers and surrounding buffers would be removed. The larger openings created could be planted with a non-susceptible species, such as ponderosa pine. This is not a control method as much as it is an attempt to return the site to productivity.

The effectiveness of creating buffers in Douglas-fir to stop further local spread of black stain root disease has not been demonstrated. It is possible that the fresh stumps created in the buffer may attract insect vectors and introduce the fungus into the edge of the buffer near the residual stand, with subsequent spread of the disease into the stand. Any attempts at this technique should be considered experimental and I would suggest the involvement of Forest Pest Management personnel to help monitor the efficacy of treatment.

3. Precommercial Thinning. A number of plantations that will require spacing are in the vicinity of the two plantations we visited. Because of the occurrence of black stain root disease following thinning in the two Mosquito

plantations, it is likely that newly thinned plantations in the area may also become infected. At present, we do not have adequate information to tell us how to manage stands in this situation. Based on our knowledge of the fungus, however, we believe that thinning plantations when the trees are small may limit the eventual size of disease centers. A maximum size limit is not known, but 6-8 feet tall is suggested. It is not known how to reduce the likelihood of disease incidence in established stands.

In addition to possibly limiting the creation of root disease centers, early thinning may reduce the hazard from Douglas-fir engraver, Scolytus unispinosus. This insect may breed in green Douglas-fir slash greater than 3 inches in diameter. Engraver beetles emerging from a concentration of larger slash could attack and kill some of the residual stand. Little is known about the life cycle of this beetle except that it apparently completes two generations during the summer. Unless slash larger than 3 inches diameter is burned within about 6 weeks after cutting, it is probably safest to restrict large thinning or clearing projects to the period from July through December. Lopping of slash over 3 inches diameter and scattering the slash in sunny areas should also reduce breeding success by the Douglas-fir engraver.

4. Modify Harvesting. There is some evidence that the incidence of black stain root disease is higher on sites that had been harvested with tractors rather than with cable systems. In areas where black stain root disease is a concern, it has been suggested that tractor logging be limited, even on gentler slopes. Where this type of limitation is not possible, minimizing the amount of skid trails and limiting tractors to the trails may be beneficial. We discussed the advisability of tractor piling of slash after logging with respect to the possible increase in incidence of the root disease. It is not known why the disease is more common on tractor-logged sites and if soil compaction and disturbance are possible reasons. These seem to be likely candidates and until more information is available it may be advisable to limit soil disturbance on sites near areas where the disease is already present.

If there are any questions about this report or you would like additional assistance, please contact me at (916)246-5101.

Gregg A. DeNitto

GREGG A. DeNITTO
Forest Pathologist
Northern California FPM Service Area